Claims

1. Method for measuring a light flux (11) backscattered by a dispersed medium (12) located on a first (13) side of a wall (14), by interaction with a plurality of light rays (15) emitted from the second (16) side of said wall which is opposite the first wall, where the dispersed medium is located and in the direction of the latter, said plurality of light rays being able to traverse said wall and being backscattered at least partially by said dispersed medium in the direction of receiving means (17) located on the second side of the wall, *characterised in that* said method comprises at least the following steps:

   - emitting said plurality of light rays (15) in the direction of said dispersed medium and through said wall (14) so that said dispersed medium is able to emit in turn, through said wall, a plurality of backscattered light rays (11) with the aim of forming a backscattering spot (19) in which at least one central zone (20) in the form of a disc is defined, the centre (21) of which corresponds to the luminous barycentre of the backscattering spot (19) and the radius (36) of which is equal to four times the maximum free travel path (l^*_{max}) of said dispersed medium, said backscattering spot (19) being able to be imaged at least in part on said receiving means (17),

   - forming said backscattering spot (19) from backscattered light rays which have traversed said wall and are free, at least according to a direction (22) extending from the luminous barycentre of said backscattering spot, of light rays which have emanated from said central zone and have undergone a total reflection on the surface (30) forming the interface of said wall (14) with said second (16) side,

- measuring at least one spatial sample of a profile of the light flux in said thus obtained backscattering spot (19), extending in said at least one direction (22).

2. Method according to claim 1, *characterised in that* it comprises:

   - forming said backscattering spot (619) from backscattered light rays which have traversed said wall and are free, between two directions (622, 635) extending from the luminous barycentre of said spot, of light rays which have emanated from said central zone and have undergone a total reflection on the surface forming the interface of said wall with said second side,

   - measuring at least one spatial sample of a profile of the light flux in said thus obtained backscattering spot (619), extending at least over a surface (625) defined between the two said directions (622, 635) which intersect at said luminous barycentre.

3. Method according to claim 1 or 2, *characterised in that* it comprises furthermore determining the values of the free travel path (l^*) and of the absorption length (l_a) using a determined photon-dispersion interaction model, from said spatial sample of a profile of the light flux.

4. Method according to any of the claims 1 to 3, *characterised in that* it comprises avoiding the return into said dispersed medium (12, 112, 212) of the light rays which have emanated from said central zone and have undergone a total reflection on the surface (30, 130, 230) forming the interface of said wall (14, 114, 214) with the second (16, 116, 216) side.

5. Method according to claim 4, *characterised in that* it comprises associating a first (29) surface forming the interface of said wall (14)

with said first (13) side, with a second (30) surface forming the interface of said wall with said second (16) side, said first and second surfaces being parallel.

6. Method according to claim 5, *characterised in that* the usable half-width (31) of said wall (14) is less than or equal to twice the thickness of said wall minus four times the maximum free travel path (l^*_{max}) of said dispersed medium (12).

7. Method according to claim 4, *characterised in that* it comprises associating a first (129, 229) surface forming the interface of said wall (114, 214) with said first (113, 213) side, with a second (130, 230) surface forming the interface of said wall with said second (116, 216) side, said first and second surfaces being non-parallel.

8. Method according to claim 7, *characterised in that* said first (129) surface forming the interface of said wall with said first (113) side is curved, and said second (130) surface forming the interface of said wall with said second (116) second side is flat.

9. Method according to claim 8, *characterised in that* said first (129) surface forming the interface of said wall (114) with said first (113) side is cylindrical.

10. Method according to claim 7, *characterised in that* said first (229) surface forming the interface of said wall (214) with said first (213) side is flat, and said second (230) surface forming the interface of said wall with said (216) second side is concave.

11. Method according to claim 10, *characterised in that* said second (230) surface forming the interface of said wall (214) with said second (216) side is conical or truncated.

12. Method according to any of the claims 1 to 3, *characterised in that* it comprises avoiding the total reflection of a light ray which has emanated from said central zone and has undergone a total reflection on the surface forming the interface of said wall (414) with the second (416) side, though which the backscattered light rays pass which are intended to form said backscattering spot.

13. Method according to claim 12, *characterised in that* the formation of a light ray which has emanated from said central zone and has undergone a total reflection on the surface (430, 530) forming the interface of said wall (414, 514) with the second (416, 516) side is avoided by adopting an appropriate form of said interface surface such that the backscattered light rays which impinge upon said interface surface have an angle of incidence (α_i) which is less than the angle of total reflection.

14. Method according to claim 13, *characterised in that* it comprises associating a first (429, 529) flat surface forming the interface of said wall (414, 514) with said first (413, 513) side, with a second (430, 530) convex surface forming the interface of said wall with said second (416, 516) side.

15. Method according to claim 14, *characterised in that* said second (430) surface adopts a spherical cap form.

16. Method according to claim 14, *characterised in that* said second (530) surface adopts a truncated form.

17. Device (10) for measuring a light flux (11) backscattered by a dispersed medium (12) located on a first (13) side of a wall (14), by interaction with a plurality of light rays (15) emitted from the second (16) side of said wall which is opposite the first side, where said dispersed medium is located and in the direction of the latter, said

plurality of light rays being able to traverse said wall and being backscattered at least partially by said dispersed medium in the direction of receiving means (17) located on the second side of the wall, said wall being able to be traversed by said emitted and backscattered light rays, and to be in contact with said dispersed medium, said device being *characterised in that* it comprises:

- means (18) for emitting, towards said wall, a light radiation (15) which is able to traverse the wall (14) and to reach said dispersed medium, so that the latter can emit in turn, through said wall, a plurality of backscattered light rays (11) with the aim of forming a backscattering spot (19) in which at least one central zone (20) in the form of a disc is defined, the centre (21) of which corresponds to the luminous barycentre of the backscattering spot and the radius (36) of which is equal to four times the maximum free travel path (l^*_{max}) of said dispersed medium, said backscattering spot (19) being able to be imaged at least in part on said receiving means (17),

- means (17) for receiving light radiation backscattered by said dispersed medium through said wall and intended to form said backscattering spot, said receiving means covering at least one direction (22) extending from the luminous barycentre of said spot,

- means (23) for suppressing, from light rays backscattered by said dispersed medium, light rays (33) which have emanated from said central zone (20) and have undergone a total reflection on the surface (30) forming the interface of said wall (14) with said second side (16),

- means (24) for measuring a spatial sample of the profile of the light flux received by one part at least of said receiving means.

18. Device according to claim 17, *characterised in that* said receiving means (617) extend at least over a surface (625) defined between two said directions (622, 635) which intersect at said luminous barycentre.

19. Device according to claim 17 or 18, *characterised in that* it comprises means (27) for calculating the values of the free travel path (l^*) and the absorption length (l_a) of said dispersed medium (12) from a measurement of said spatial sample of the profile of the light flux.

20. Device according to any one of the claims 17 to 19, *characterised in that* said means (23) for suppressing backscattered light rays which have emanated from said central zone and have undergone a total reflection on the surface forming the interface of said wall with said second side, comprise means (28) for diverting, out of said dispersed medium (12, 112, 212), said light rays which have undergone a total reflection, said diverting means comprising the association of a first (29, 129, 229) surface forming the interface of said wall (14, 114, 214) with said first (13, 113, 213) side, and of a second (30, 130, 230) surface forming the interface of said wall with said second (16, 116, 216) side.

21. Device according to claim 20, *characterised in that* said first (29) and second (30) surfaces are flat and parallel, the usable half-width (31) of said wall, with the aim of forming said backscattering spot (19), being less than or equal to twice the thickness (32) of said wall (14) minus four times the maximum free travel path (l^*_{max}) of said dispersed medium (12).

22. Device according to claim 20, *characterised in that* said first surface (129) forming the interface of said wall (114) with said first (113) side is curved, and said second (130) surface forming the interface of said wall with said second (116) side is flat.

23. Device according to claim 22, *characterised in that* said first (129) surface forming the interface of said wall (114) with said first (113) side is cylindrical.

24. Device according to claim 20, *characterised in that* said first (229) surface forming the interface of said wall (214) with said first (213) side is flat, and said second (230) surface forming the interface of said wall with said second (216) side is concave.

25. Device according to claim 24, *characterised in that* said second (230) surface forming the interface of said wall (214) with said second (216) side adopts a conical or truncated form, the axis (250) of the cone or of the truncated part being perpendicular to the first (229) flat surface.

26. Device according to any of the claims 17 to 19, *characterised in that* said means (423) for suppressing backscattered light rays which have emanated from said central zone and have undergone a total reflection on the surface (430) forming the interface of said wall (414) with said second side (416), comprise means (460) for preventing the formation of a said light ray which has undergone a total reflection, on this said surface (430) forming the interface of said wall (414) with the second (416) side.

27. Device according to claim 26, *characterised in that* said means (460) for preventing the formation of a light ray which has emanated from total reflection, on the surface (430) forming the interface of said wall (414) with the second (416) side comprise an appropriate form of said interface surface in order that the backscattered light rays which impinge upon this said interface surface have an angle of incidence (α_i) which is less than the angle of total reflection.

28. Device according to claim 27, *characterised in that* said means (460) for preventing the formation of a light ray which has emanated from total reflection, on the surface (430) forming the interface of said wall (414) with the second (416) side comprise a first (429) flat surface forming the interface of said wall with said first (413) side associated with a second (430) convex surface forming the interface of said wall with said second side.

29. Device according to claim 28, *characterised in that* said second (430) surface adopts a spherical cap form.

30. Device according to claim 28, *characterised in that* said second (530) surface adopts a truncated form.